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XCVII. *An Attempt to improve the Manner of working the Ventilators by the Help of the Fire-Engine. In a Letter to Tho. Birch, D. D Secret. R. S. from Keane Fitz-Gerald, Esq; F. R. S.*

S I R,

Read June 8, 1758. **T**HE reverend and ingenious Dr. Hales, from whom mankind has received such benefit by his useful application of ventilators, being inclined to extend its use to those, who work in mines at great depths under ground, where the lives of many are lost by damps and noxious vapours, occasioned by the want of a free circulation of air; and finding by experience, that ventilators worked by wind do not operate above one third part of the year, and in calm hot weather, when most wanted, do not operate at all; did me the honour of applying to me for assistance in contriving a machine to work the ventilator, by the help of the fire-engine, which is now generally used in all mines for drawing off the water; and which I have accordingly attempted, and hope it will answer the purpose.

As the lever of the fire-engine works up and down alternately, and performs at a common medium about a dozen strokes in a minute, it was necessary to contrive some way to make the beam, tho' moving alternately, to turn a wheel constantly round one way, and also to increase the number of strokes to fifty or sixty in a minute.

The

The model of a machine for this purpose is composed of four wheels of different sizes, two clicks, three pinions, and a fly ; which is put into motion by the part of a wheel fixed to the arch of the lever of the fire-engine.

The wheel, which is turned by the lever, or rather moved up and down by it, is loose on its arbor ; and likewise one of the rochets, and the wheel next to it. The outside rochet and outside wheel are fixed on the arbor.

There are two pinion-wheels fixed on the arbor ; one on each side, near the edge of the wheel moved by the lever, which turns them.

There are also two clicks ; one fixed to the great wheel, the other to the frame. These exclusive of the wheel that moves the fly.

The effect is, When the lever moves the wheel downwards, its click forces the rochet fixed on the arbor to move along with it, and the other wheels the same way. When it moves upwards, the click fixed on the frame stops the larger rochet, and the wheel next to it, which are pinned together. This wheel being stopped, and the great wheel carried upwards by the lever, the pinion towards the edge of the great wheel is forced round it, and moves the pinion on the other side the great wheel ; which pinion moves the wheel fixed on the arbor, the contrary way to the great wheel, which is carried upwards by the lever. By which means, the arbor is constantly turned the same way, when the lever of the fire-engine is moved either upwards, or downwards.

Upon the arbor there is also another great wheel fixed, which turns a pinion : on the arbor of which
pinion

pinion is a crank to move the ventilator, and also a fly fixed to the end, to help the motion of the crank, which in the model is turned three times for each stroke of the lever, and may be increased or diminished, according to the number of teeth in the pinion.

The number of teeth in the great wheel moved by the lever is sixty-six; but need not have teeth above half way round.

The wheel fixed to the rochet has thirty-three teeth, and its pinion eleven.

The wheel fixed on the arbor, on the outside, has twenty-four teeth, and its pinion sixteen.

The wheel, which turns the fly, has ninety teeth, and the pinion turn'd by this wheel ten.

The greater the number of teeth in the rochets, the better.

This machine may also be applied to other useful purposes at mines; and it may be easily made to turn a mill to grind corn; or to turn a wheel to raise coals, or whatever else is wanted to be raised from the mines. As I have not met with any thing of the kind described, I take the liberty of desiring you to lay it before the Society; and I hope it may be made some way useful to the public.

I am, Sir,

Your most obedient humble Servant,

Poland-Street,
June 7th, 1758.

Kea. Fitz-Gerald.

Explanation of the Three Tables.

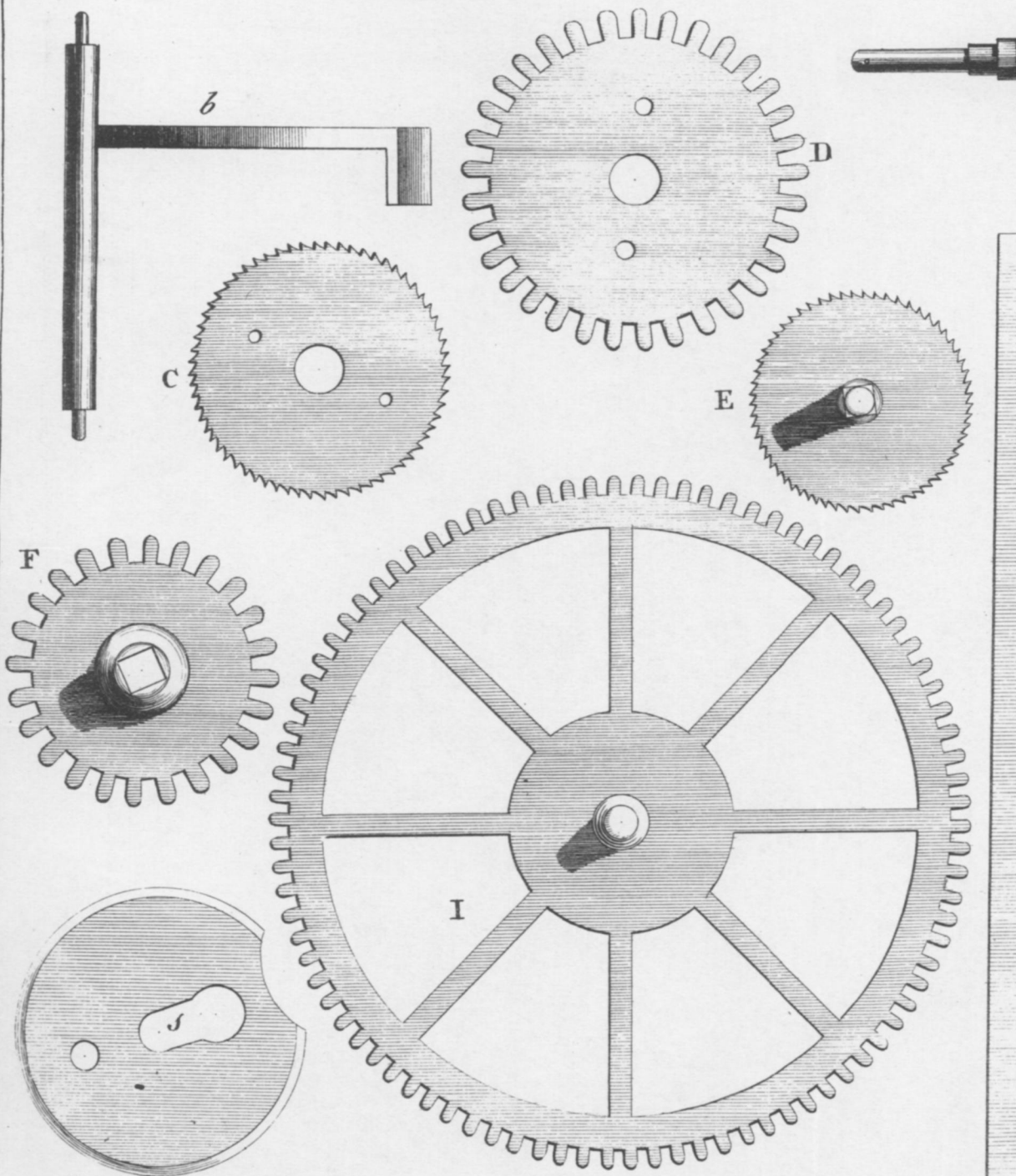
The wheel A (*Tab. 26.*), which is turned by the lever B (*Tab. 27.*), or rather moved up and down by it, is loose on its arbor; and likewise one of the rochets C (*Tab. 26.*), and the wheel next to it D. The outside rochet E, and outside wheel F, are fixed on the arbor.

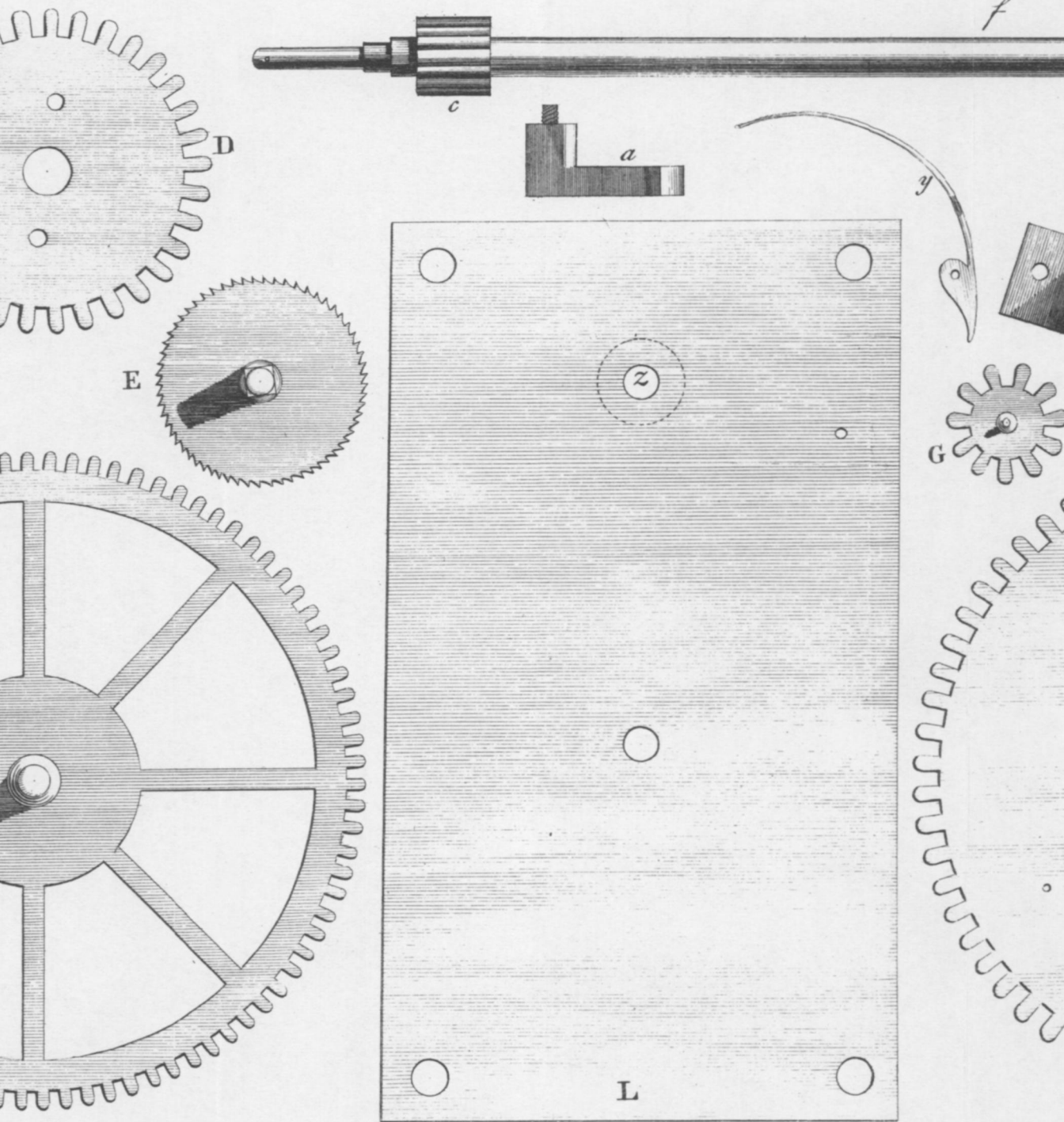
There are two pinion-wheels G and H fixed on one arbor; one on each side, near the edge of the wheel A, moved by the lever.

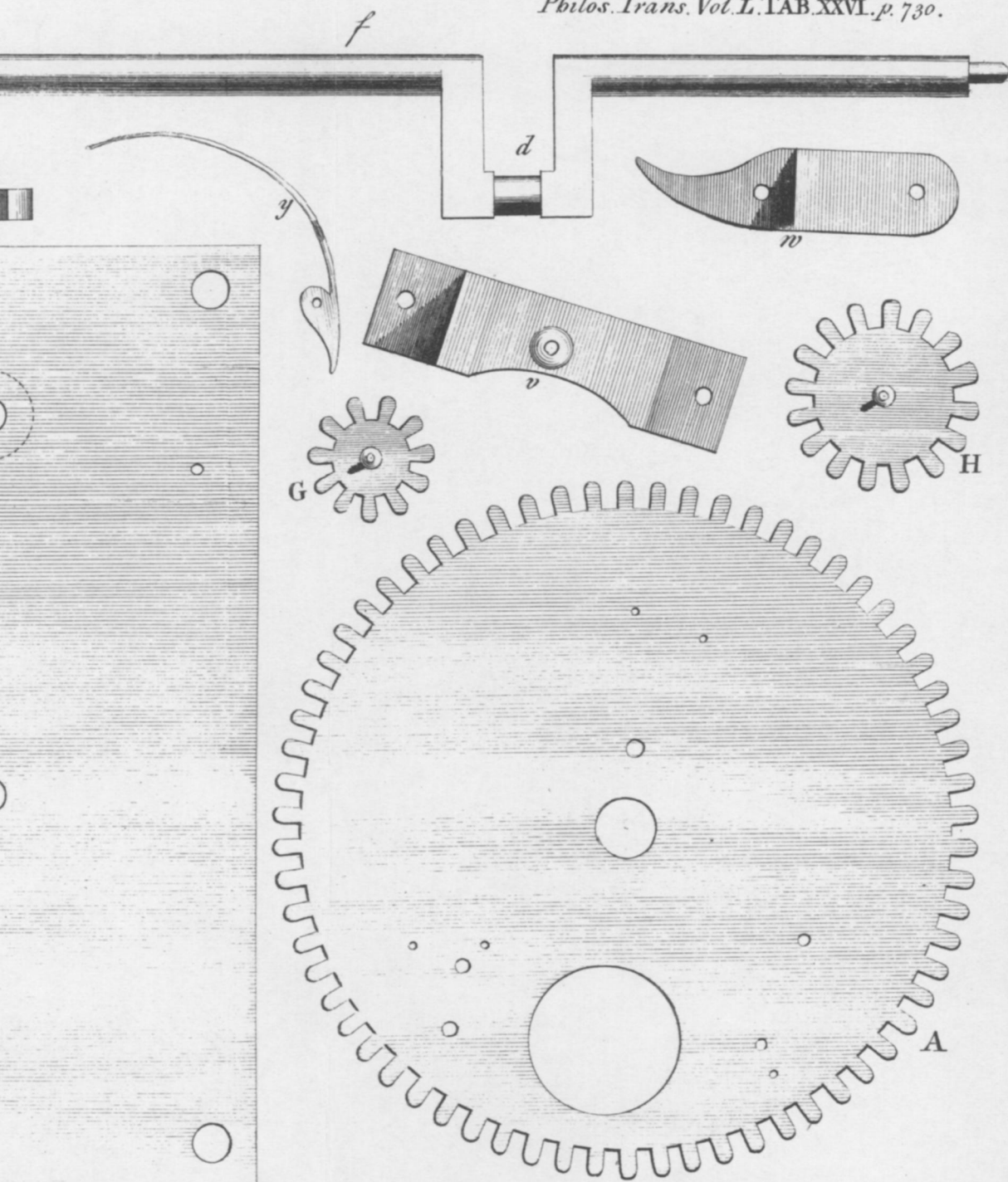
There are also two clicks *a* and *b*; one *a* fixed to the great wheel A, the other *b* fixed to the frame. These exclusive of the wheel I, that moves the pinion *c*, on the arbor of which, the crank *d*, and fly *e*, (*Tab. 27.*) are fixed.

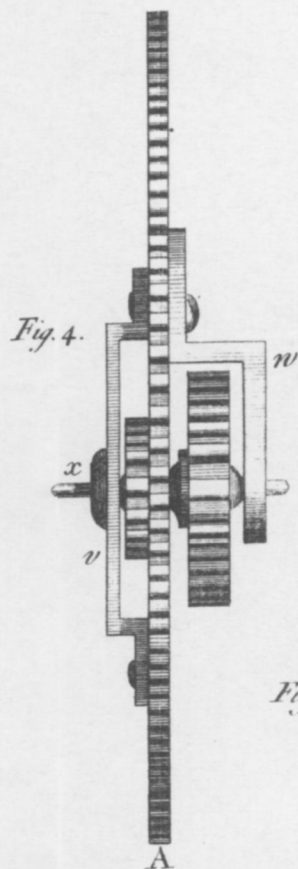
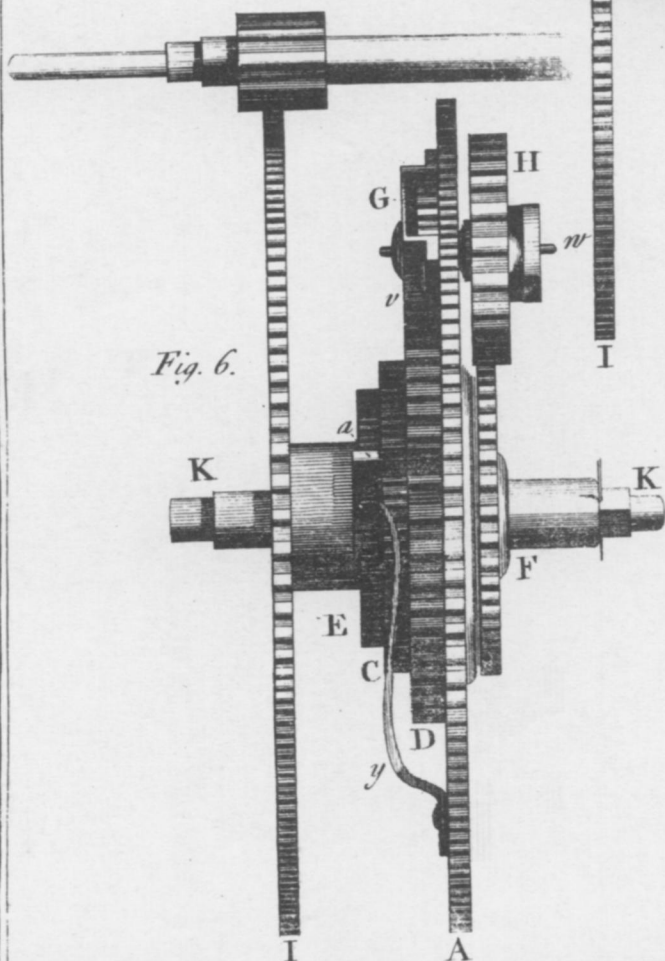
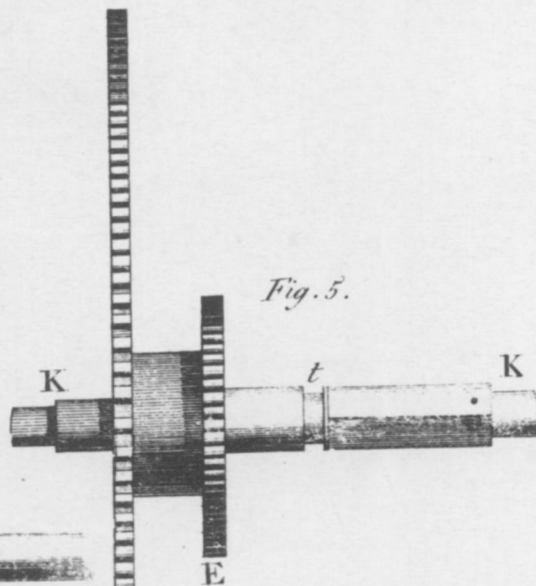
The effect is, when the lever B moves the wheel A downwards; its click *a*, forces the rochet E, fixed on the arbor K, to move along with it, and the other wheels the same way. When it moves upwards, the click *b* fixed to the frame, stops the larger rocket C, and the wheel D next to it, which are pinned together; and as the wheel A is carried upwards by the lever, the pinion G towards the edge of it, is forced round the wheel D, and moves the pinion H, on the other side the great wheel A, which moves the wheel F fixed on the arbor K, the contrary way to the wheel A. By which means, the arbor K is constantly turned the same way, when the lever of the fire-engine moves either upwards, or downwards.

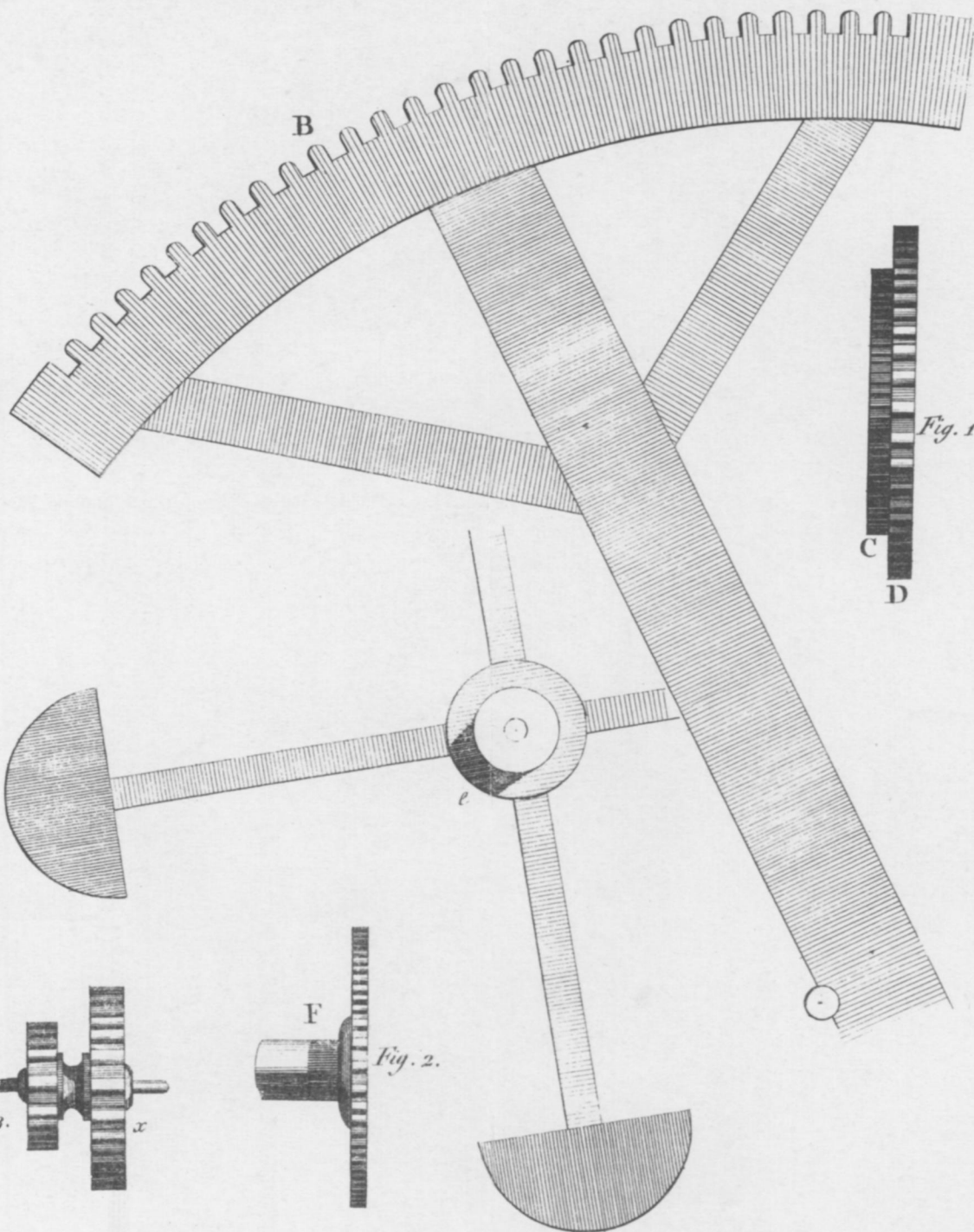
The pinion G, by being made proportionally smaller than the pinion H, keeps the arbor K in the
same

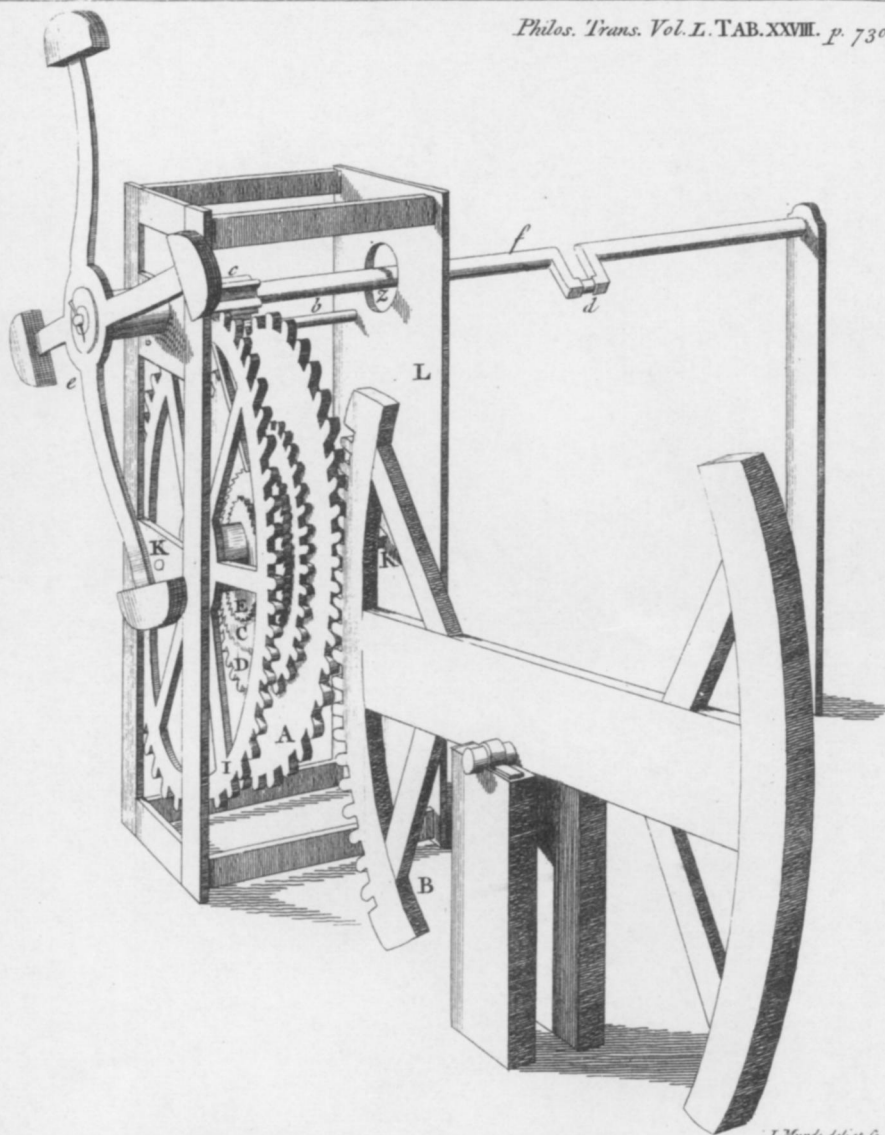












same swiftness of motion, when the lever is moved upwards, as downwards.

The great wheel I, fixed on the arbor K, turns the pinion *c*, on the arbor of which the crank *d* (to move the ventilator), and the fly *e* (to help the motion), are fixed. The pinion *c*, is turned three times by each alternate motion of the lever; which may be increased, or diminished, according to the number of teeth in the pinion *c*.

The number of teeth in the wheel A is sixty-six, but need not be toothed above half way. Instead of this wheel there might be a barrel, with a chord round it, fixed at each end of the arch of the lever, and projecting somewhat from it; which, by the motion of the lever, would work in the same manner in other respects, and be easier made, and at less expence.

The wheel D fixed to the rochet C has thirty-three teeth, and its pinion G eleven.

The wheel F fixed on the arbor K has twenty-four teeth, and its pinion H sixteen.

The greater the number of teeth in the rochets, the better.

Tab. 26. contains the plan (in parts) of the whole machine, except the lever B and fly *e*, which are in *Tab. 27.*

Tab. 27. also contains the elevation of the arbor, with its different fixtures; *viz.*

Fig. 1. The rochet C and wheel D (*Tab. 26.*) fixed together.

2. The outside wheel F that works the pinion-wheel H (*Tab. 26.*).

5 A 2

Fig.

Fig. 3. The two pinion-wheels H and G (*Tab. 26.*) fixed on their arbor.

4. The same fixed to the wheel A (*Tab. 26.*) by means of two cocks *u* and *w* (*Tab. 26.*).

5. The arbor, with the wheel L and rochet E fixed; *t* the place, where the wheel A is fixed.

6. The elevation of the whole arbor.

Tab. 28. The elevation of the whole machine, the lever B (*Tab. 27.*) working the wheel A (*Tab. 26.*).

s (*Tab. 26.*) a thin piece of metal screwed to the wheel A, to keep it in its place *t* on the arbor K (*Tab. 27.*)

u (*Tab. 26.*) the cock, that fastens the pinion G, to the inside of the wheel A.

w (*Tab. 26.*) the cock, that fastens the pinion H on the outside of the wheel A.

x (*Tab. 27.*) the arbor, on which the pinions G and H are fixed.

y (*Tab. 26.*) a spring, that keeps the click *a* in its place.

L (*Tab. 26.*) a frame-plate with the centers marked.

z The opposite hole enlarged, to admit the pinion *c* to pass through.